

## ATOM MODELS ANSWERS

2004

2(a)	Otherwise the alpha particles would have been stopped by the molecules of the gases in the air.		<sup>1</sup> Alpha particles have short range in air so would not get to foil/alpha particles cannot penetrate the air so would not get to foil/ alpha particles would have been stopped by the molecules of the gases in the air and so would not get to foil.	
2(b)	Positive or 2+	<sup>1</sup> Positive or 2+		

2(c)	<p>Most of the atom is <b>empty space</b>. Because most of the alpha particles <b>passed through undeviated</b>.</p> <p>There must be something <b>dense</b> and/or <b>positive</b> in the atom. Alpha is positive, and <b>undergoes deflection</b>, so whatever it hit must be dense and/or positive.</p>	<p><sup>1</sup> Two conclusions described from the key concepts:</p> <ul style="list-style-type: none"> <li>• Most of the <b>atom</b> is empty space/ The <b>nucleus</b> is very small.</li> <li>• There must be something <b>dense</b> in the atom/dense nucleus.</li> <li>• There must be something <b>positive</b> in the atom/positively charged nucleus.</li> </ul>	<p><sup>1</sup> Two conclusions described from the key concepts. <b>One</b> explanation correctly linked to conclusion.</p>	<p><sup>1</sup> Two conclusions described from the key concepts. <b>Both</b> explanations correctly linked to conclusion.</p>
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2005

1(a)	<p>Thomson's and Rutherford's models both:</p> <ul style="list-style-type: none"> <li>• contain (negative) electrons</li> <li>• involve subatomic particles</li> <li>• involve atoms with smaller particles inside</li> <li>• contain positive charges</li> <li>• contain negative charges</li> <li>• contain (balanced) positive and negative charges</li> <li>• atoms are neutral overall.</li> </ul> <p>Accept any one of these – an answer that involves <b>protons</b> in both models <b>cannot be accepted</b>.</p>	Correct statement of similarity.		
1(b)	Thomson's model consisted of negative electrons embedded in a sphere of positiveness / accept "solid"; but Rutherford's electrons were in orbit around a (small) positive nucleus.	<p>Thomson's model described and <b>either</b></p> <ul style="list-style-type: none"> <li>• electrons in orbit</li> <li>• (small) positive nucleus / mass in centre of Rutherford's model explained (neutron mentioned in answer does not negate answer).</li> </ul>	<p>Both Thomson's model described and <b>both</b> of</p> <ul style="list-style-type: none"> <li>• electrons in orbit</li> <li>• (small) positive nucleus / mass in centre of Rutherford's model explained (neutron mentioned in answer does not negate answer).</li> </ul>	

2	<p>1. Only a few alpha particles bounced back because the nucleus is so small / atom is mostly empty space that few collided with the nucleus.</p> <p>2. If they bounced back it was because both alpha particle and nucleus are positive: repulsion</p> <p>3. If they bounced back it was because nucleus is massive / dense so alpha particles rebound.</p>	One correct reason (any from 3) but no explanation.	<p>Correct Reason 1 (atoms are mostly space etc.) with explanation</p> <p><b>OR</b></p> <p>correct Reason 2 with explanation (repulsion because of like charges etc).</p> <p>(Reason 3 not accepted as answer but if used does not negate.)</p>	<p>Correct Reason 1 with explanation</p> <p><b>AND</b></p> <p>correct Reason 2 with explanation.</p> <p>(Reason 3 not accepted as answer but if used does not negate.)</p>
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2006

1(a)	A helium nucleus OR a doubly ionised helium atom OR two protons and two neutrons (joined) OR a helium atom with no electrons	Correct answer.		
1(b)	<p>To prevent the alpha particles being stopped by gas molecules.</p> <p>Accept: stopped, deviated, can't travel long distance in air, air disrupts path.</p> <p>Don't Accept: affect, react, interfere, prevent ionisation.</p>	Correct answer.		
1(c)	To provide a narrow (or collimated) beam of alpha particles OR ensure alpha hits perpendicular to gold foil.	Correct answer.		
1(d)	Most of the gold <b>atom</b> is empty space.	Correct answer.		
1(e)	<p>The nucleus must be <b>positively</b> charged to cause the <b>positive</b> alpha particles to <b>repel</b> (or rebound).</p> <p>The nucleus must be <b>dense</b> to cause the alpha particles to <b>rebound</b>.</p>	One description correct.	<p>Both descriptions correct</p> <p><b>OR</b></p> <p>One description correct and one correct explanation.</p>	<p>Both descriptions correct</p> <p><b>AND</b></p> <p>one correct explanation.</p>

2007

ONE (a)	<p>The Dalton model proposed that matter was made of <b>indivisible atoms</b> / <b>smallest building block of matter</b> (The Dalton model had no electrons or protons).</p> <p>The Thomson ("plum pudding") model proposed that the atom was a <b>positive sphere</b> with negatively charged <b>electrons embedded in it</b>. The atom as whole was neutral. (The Thomson model did not have protons.)</p> <p>The Rutherford model proposed that the atom had a <b>central positive nucleus</b>. The negatively charged <b>electrons were in orbit</b> around the nucleus of the atom. The atom as whole was neutral. The <b>atom was mainly space</b>. (The Rutherford model had electrons and</p>	<p>Dalton model <b>OR</b> Thompson model <b>OR</b> 2 of 3 ideas from Rutherford model explained.</p> <p>(Neutron mentioned in Rutherford model does not negate answer.)</p>	<p><b>TWO</b> models correctly explained.</p> <p>(2 of 3 ideas from Rutherford model is sufficient.)</p> <p>(Neutron mentioned in Rutherford model does not negate answer.)</p>	<p><b>ALL</b> models correctly explained.</p> <p>(2 of 3 ideas from Rutherford model is sufficient.)</p> <p>(Neutron mentioned in Rutherford model does not negate answer.)</p>
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	protons.)  (Thomson and Rutherford BOTH predicted the atom was mainly space.)			
(b)	(Most of) the alpha particles would go straight through / alpha particles should only be deflected by small angles as they pass through / uniform scattering.	(Most of) the alpha particles would go straight through / alpha particles should only be deflected by small angles as they pass through / uniform scattering.		
(c)	(Most of the) alpha particles went straight through. (Some of the) particles were deflected away. (A very few of the) particles were reflected right back / deflected through large angles.	<b>TWO</b> correct observations.	<b>ALL THREE</b> correct observations.	
(d)	If air were present in the chamber the alpha particles would not travel far (alpha particles can penetrate only 5cm in air) / be stopped / lose energy / path would change / be deviated <b>because</b> of collisions with air particles. The air (particles) would be ionised / become positively or negatively charged / lose electrons / change from atoms to ions <b>because</b> alpha particles are highly ionising and they would ionise the air as they passed through it.	Alpha particles would not travel far / be stopped / lose energy / path would change / be deviated (do not accept “affect”, “react”, “interfere”) / alpha becomes a helium atom <b>OR</b> Air would be ionised / become positively or negatively charged / lose electrons / change from atoms to ions (do not accept “react”).	Alpha particles would not travel far / be stopped / lose energy / path would change / be deviated (do not accept “affect”, “react”, “interfere”) / alpha becomes a helium atom. <b>AND</b> Air would be ionised / become positively or negatively charged / lose electrons / change from atoms to ions (do not accept “react”).	
(e)	Beta particles (which are more penetrating) would almost all go straight through the gold foil. <b>OR</b> Greater scattering effect so more Beta particles deflected through large angles (very few would be scattered through small angles) <b>OR</b> greater backscattering.	(Almost all) Beta particles would through the gold foil. <b>OR</b> More Beta particles scattered through large angles / greater backscattering.		